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ABSTRACT

This study explored the developmental changes in children's effective utilization of verbal versus pictorial stimuli in forming connections between stimulus and response elements in a paired-associate task. A total of 112 children (56 males and 56 females), half of them 4-year-olds and half 8-year-olds, were tested under eight conditions involving three variables. The first variable was mode of study, which was either a pictorial or a verbal original presentation of the items. The second variable was mode of test, which was either a pictorial or a verbal presentation of the test items. The third variable was the presence or absence of a mnemonic on the original trials. The mnemonic was either a sentence or an interaction picture combining the elements of each pair. In all conditions, each pair contained an animal as a stimulus term and a common object as a response term. Within-list and extra-list distractor pairs were used on the test trials. Results showed that 4-year-old and 8-year-old children performed significantly better with a mnemonic than without one. After a visual study trial, younger children had difficulty performing on a verbal recognition test but performed better on a pictorial recognition test. The performance of 8-year-olds showed no significant differences for test mode or study mode. (Author/BRT)

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Visual and Verbal Memory Processes in Children's Paired-Associate Learning

by

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PS 008404

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Visual and Verbal Memory Processes

in Children's Paired-Associate Learning

In recent years there has been considerable controversy over developmental changes in the effective utilization of verbal versus visual elaboration in forming connections between stimulus and response elements in a paired-associate task. Many studies have reported that young children make more efficient use of verbal than pictorial elaboration in learning paired-associates while older children are more efficient in use of visual elaboration (e.g. Milgram, 1967, Reese, 1965). The data are puzzling in view of many developmental theories which focus on the earlier acquisition of pictorial representation and the difficulties which the young child has in getting words to serve a controlling function. In addition to the theoretical proposals that verbal elaboration ought to follow rather than precede visual elaboration, there are also methodological flaws in the studies of elaboration.

Dilley and Paivio (1968; Paivio 1970) have suggested that the failure of young children to use pictorial material is a function of decoding, not encoding. The young child is able to encode and store the material in image form, but is not as efficient as the older child at decoding these images into a verbal form. Previous investigators had required the subject to give an overt verbal response on the test trials. If the child is supplied with a verbal code the task is easy but when the child is provided with pictorial stimuli he must translate that image into a verbal code. Dilley and Paivio suggested that young children might have more difficulty than older children in doing such coding. It has been hypothesized that with increasing age a child becomes more adept at translating from non-verbal images to verbal modes of of cognitive representation when the task requires it.

The following study stems from the Dilley and Paivio analysis and is addressed to several issues. First, if the problem is verbal recall then the use of a recognition task should eliminate the need for children to translate visual images into verbal codes and thus the difference between visual and

verbal stimuli should disappear. By varying the modality of input and recognition, a test of the difficulty of translating material across modalities could also be assessed. Secondly, by using a recognition paradigm one might be able to focus more clearly on problems in the use of mnemonics. A recall task places more demands on retrieval; thus the recognition paradigm allows a closer assessment of the modality of encoding or storage.

There have been several studies which have used a recognition design but the studies have produced inconsistent results and their designs have precluded making inferences about the relative efficacy of verbal versus visual encoding at various ages.

Studies by Jones (1973) and Davidson, Adams (1972) used only one age group. Davidson and Adams and Holyoak, Hogeterp and Yuille (1972) confounded verbal and visual presentation mode.

The following study varies the age of the subject, the mode of presentation and the mode of testing, and the presence or absence of a verbal or visual connective using a recognition paradigm.

METHOD

Design. The experiment consisted of eight conditions with three variables involved in the design. The first variable was mode of study, which was either a visual or a verbal presentation of the study items. The second variable was the mode of test, which was either a visual or a verbal presentation of the test items - original study pairs and distractor pairs. The third variable was the presence or absence of a mnemonic on the study trials - the mnemonics were either the presentation of a sentence combining the elements of each pair or the presentation of an interaction picture combining the elements of each pair.

Subjects. The sample consisted of 112 children equally divided between two ages, four and eight years (mean ages - 4.5 and 8.7 years). There were an equal number of males and females in each condition.

Materials. In all conditions each paired-associate contained an animal as stimulis term and a common object as response term. In the verbal control groups and in all verbal recognition test groups the paired-associate list consisted of the spoken names of each object in the pair. In the verbal context groups the stimulis and the response of each were placed in a spoken sentence which described a given interaction - the interactions employed action verbs such as push, kick, and lick. For example, the cat licks the lollipop.

The paired-associate list in the visual control groups and all visual recognition test groups consisted of pictures of the stimulis-response objects placed on 5X7 inch cards. All pictures were hand-drawn with colored details. In the visual context groups the stimulis and response objects of each pair were pictorially depicted in an interaction corresponding to those employed in the verbal context conditions.

A common pool of high frequency items was employed for the two age levels. The study list consisted of four and eight pairs depending on the age group. The test list consisted of twelve pairs for the four year olds and twenty-four pairs for the eight year olds.

The test list was composed of the original stimulis-response pairs presented on study trials and new distractor pairs. The distractor pairs employed on the recognition test trials consisted of two types. Half of the distractors were "within-list" distractors, constructed by taking each stimulis and pairing it with a different response from within the original study list. The other half of the distractors were "extra-list" distractors, constructed by taking each stimulis and pairing it with a completely new response item which had never been presented in the study list. For the "within-list" distractors, a stimulis item was paired with three different "within" response distractors over the three test trials. For the "extra-list" distractor pairs, a response item which belonged to the category "extra-list" appeared only once over all test trials.

Procedure. The children differed in the method of presentation of the materials depending on the specific condition. As shown in Table 1, the first label refers to the method of presentation of materials on study trials and the second label refers to the method of presentation on the test trials.

Each child was tested individually and was given the paired-associate list for three trials with the study-test method of paired-associate learning. On the study trials the child saw each pair (or heard each pair) at a 5 second rate of presentation. He was told to remember the object which was matched with each animal. Then he was given a recognition test in which original pairs and distractor pairs were presented one at a time at a 10 second rate. As a recognition test pair was presented the child was asked a question of the format: In verbal test. "Was (stimulis name) matched with (response name)?" or in visual test. "Was this (shown stimulis picture) matched with this (shown response picture)?" The child was to respond Yes or No depending on whether he thought the stimulis and response were correctly matched on the test.

RESULTS

The recognition data were analyzed in terms of the number oc "completely correct hits", which is a strict measure referring to an old pair correctly identified and no false alarms made when either the stimuli or the response term of that pair was presented with some other term. A four way analysis of variance was performed on the number of completely correct hits and was conducted separately for the two age groups, 4 and 8 years.

Four year old. The mean number of completely correct hits, averaged over three trials, for each group in the four year old age group is presented in Table 1. A significant main effect was found for the presence or absence of a mnemonic at the .01 level, indicating that the presence of a mnemonic on study trials substantially facilitates performance. A significant main effect was also found for test mode, $p < .01$. The verbal test was more difficult than the visual test for these young children.

One interaction was also significant at the .01 level, that of study by test mode. Tukey tests indicated that only two of the four means were significantly different: the Visual study - Verbal test versus the Visual study-Visual test groups. The younger children have difficulty performing on a verbal test trial when given a visual study trial. The final significant effect was the effect of trials, indicating that learning had occurred.

Eight year old. The mean number of completely correct hits, averaged over three trials, for each group in the eight year old age group is presented in Table 1. As in the four year old analysis, the main effect of presence or absence of mnemonic was significant at the .01 level, indicating that the presence of a mnemonic on the study trials facilitates performance. Performance also increased over trials. With the eight year old groups no significant differences were found for test mode or study by test mode interaction, contrary to what was found in the younger children's performance.

CONCLUSION

The data revealed several critical findings. Relevant to the issue on memory representation in younger children is the discussion of the encoding and decoding abilities of the younger children. The inferior performance by the children in the visual study - verbal test groups, relative to the visual study-visual tests groups, suggests that the younger children have difficulty translating from a visual imagery mode to a verbal mode in order to respond appropriately on the verbally coded recognition test trial. The inferior performance by children who were required to switch from a visual study mode to a verbal test mode does not appear to be due simply to a difficulty encountered in changing from study to test trial as indicated by the lack of difference between the verbal-visual and verbal - verbal conditions.

It is clearly evident that the younger children are capable of handling and efficiently dealing with the visual study materials when allowed to respond in a visual mode on a subsequent test. The difficulty arises when the younger child must transform the visual image to a verbal mode. The data appear to support the Dilley and Paivio (1969) and Paivio (1970) hypothesis that imagery can be a beneficial mode of learning at all ages and the ability which younger children have not fully developed is the ability to symbolically transform images to words.

A critical issue concerned the developmental changes in the efficiency of the mnemonic strategies. In the results there were some definite developmental trends. The younger children performed much better when the test materials were visual than when they were verbal materials. The older children performed equally well with visual and with verbal test items. In addition to this age difference another difference was evident in a comparison of the visua study - verbal test group with the visual study - visual test group. As has been pointed out, the younger children exhibited very poor performance when allowed to study the material visually and then were required to respond on a verbally coded test. The older children exhibited no such difficulty with a verbal test following a visual study. These results appear to support the hypothesis that with increasing age the child develops the ability to make spontaneous transformations from images to words.

The present research has attempted to effectively demonstrate that non-verbal processes can be handled efficiently by younger children in learning and memory tasks. The results suggest that the younger children can encode visual information but are inefficient at decoding or transforming the imaginal code to a verbal code. This may account for the results of previous studies which found the younger children inefficient in processing visual materials.

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Conditions in Design:

I. Verbal context - Verbal recognition

II. Verbal context - Visual recognition

III. Visual context - Verbal recognition

IV. Visual context - Visual recognition

V. Verbal control - Verbal recognition

VI. Verbal control - Visual recognition

VII. Visual control - Verbal recognition

VIII. Visual control - Visual recognition

Results:

Mean number completely correct hits for four year old group:
(Maximum 4.0)

Study mode - Test mode	Mnemonic		No Mnemonic	
Verbal study - Verbal test	I.	2.57	V.	1.19
Verbal study - Visual test	II.	2.71	VI.	1.29
Visual study - Verbal test	III.	1.71	VII.	.78
Visual study - Visual test	IV.	3.05	VIII.	1.46

Mean number completely correct hits for eight year old group:
(Maximum 8.0)

Study mode - Test mode	Mnemonic		No Mnemonic	
Verbal study - Verbal test	I.	6.04	V.	3.38
Verbal study - Visual test	II.	5.71	VI.	3.43
Visual study - Verbal test	III.	6.24	VII.	3.48
Visual study - Visual test	IV.	6.09	VIII.	3.24